Interface Requirements Document
between
EOSDIS Core System (ECS)
and
Science Computing Facilities

May 1995

GODDARD SPACE FLIGHT CENTER

GREENBELT, MARYLAND

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CHANGE RECORD PAGE

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CH-01	07/13/95	v, vii, 3-3, 5-1, 5-2, 5-3, 11-1	CCR 505-41-12-002
CH02	12/3/95	v, vii, 3-4, 5-2, 5-3, 5-4, 5-5, 9-1, 11-1	CCR 505-01-41-091-B
CH03	03/08/96	v, vii, 3-4, 5-2, 5-3, 5-5, 11-1, 11-2	CCR 505-41-12-003-A

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Preface

This document is a formal contract deliverable with an approval code 1. It requires Government review and approval prior to acceptance and use. Changes to this document also require Government approval prior to acceptance and use. Changes to this document shall be made by document change notice (DCN) or by complete revision.

This document is under ESDIS Project Configuration Control. Any questions or proposed changes should be addressed to:

The Configuration Management Office

ESDIS Project

Code 505

GSFC

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1. Introduction

1.1 Identification

This Interface Requirement Document (IRD), Contract Data Requirement List (CDRL) item 039, whose requirements are specified in Data Item Description (DID) 219/SE1, is a required deliverable under the Earth Observing System Data and Information System (EOSDIS) Core System (ECS), Contract NAS5-60000. It defines the interface requirements between ECS and the Science Computing Facilities (SCFs).

1.2 Scope

SCFs provide support to the following types of scientists: Earth Observing System (EOS) Principal Investigators (PI); EOS Co-Investigators; EOS Team Leaders (TL); and EOS Team Members.

This document addresses those requirements unique to ECS-SCF interaction, specifically with regard to the passing of data production software, calibration coefficients, data product quality assurance information and other data between the two systems in support of data production software development of standard and special products by the scientist at the SCF and in support of data processing and data reprocessing operations. Interface requirements covering user interaction with ECS of a general nature are not covered in this document but are found in the Functional and Performance Requirements Specification for the Earth Observing System Data and Information System (EOSDIS) Core System (#423-41-02). The general user requirements not covered herein consist of those capabilities that all ECS users share such as conduct of data searches. Capabilities are included herein if they are necessary for the SCF to carry out its role as software developer and provider. SCF interfaces related to ECS communications can be found in the External Networks IRD. Interface requirements for the command, control, and monitoring of EOS instruments will be defined in satellite-specific IRDs. For example, interfaces for the MODIS instrument on AM1 will be defined in the AM1 IRD.

Table 1-1. Documents Defining SCF-Related Interfaces

Interface	Document Defining Interface
SCF-Specific Interfaces	SCF IRD
General User Interface	EOSDIS Core System (ECS) Requirements Specification
Communications-Related SCF Interfaces	External Networks IRD
Flight Project Interfaces	One IRD specific to each flight project such as AM1
Service Provider	Interface Description Document between the EOSDIS Core System (ECS) and the service providers. (Preliminary ECS Release B at CDR; Final-ECS Release B at RRR)

1.3 Purpose and Objectives

This document details the unique interface requirements between the ECS and SCFs as derived from the Level 3 requirements specified in the Functional and Performance Requirements Specification for the Earth Observing System Data and Information System (EOSDIS) Core System. The objective of this document is to provide a focus for defining related Interface Control Documents (ICDs).

1.4 Document Organization

This Interface Requirements Document is organized as described below.

Section 1 — Introduction - Introduces the IRD's scope, purpose, objectives, and document organization.

Section 2 — Related Documentation - Provides a bibliography of reference documents for the IRD organized by parent, applicable, and information subsections.

Section 3 — Systems Description - Provides an overview of both interfacing systems and a discussion of the architectural system components involved in the interface.

Section 4 — General SCF Requirements - Requirements that apply to all SCF interfaces as defined in sections 5-10.

Section 5 — Data Production Software Development Interface Requirements - Data flow descriptions and interface requirements to support data production software development

Section 6	Quality Assurance (QA) of Data Products Interface Requirements - Data flow descriptions and interface requirements to support QA of data products.
Section 7	Data Product Processing - Data flow descriptions and interface requirements to support data processing.
Section 8	Reprocessing of Data Products Interface Requirements - Data flow descriptions and interface requirements to support reprocessing.
Section 9	ECS Local Data Access Services Requirements - Data flow descriptions and interface requirements to support local data access services.
Section 10	Calibration Coefficient Update Interface Requirements - Data flow descriptions and interface requirements to support calibration coefficient update.
Section 11	ICD Plan and Requirements Trace

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2. Related Documentation

2.1 Parent Documents

The following documents are the parents from which this document's scope and content derive:

GSFC 5/21/93	EOSDIS Core System Statement of Work
GSFC 5/21/93	Functional and Performance Requirements Specification for the Earth Observing System Data and Information System (EOSDIS) Core System
193-604-OP1-001	ECS Operations Concept Document, submitted August 1993
193-216-SE1-001	ECS Requirements Specification, submitted August 1993
193-208-SE1-001	Methodology for Definition of External Interfaces, submitted May 1994

2.2 Applicable Documents

The following documents are binding for this document. In the event of conflict between any of these documents and this document, this document shall take precedence.

193-301-DV1-001	ECS System Implementation Plan, submitted May 1993
193-201-SE1-001	ECS Systems Engineering Plan, submitted May 1993
193-205-SE1-001	Science User's Guide and Operations Procedure Handbook for the ECS Project (latest revision).
193-219-SE1-001	Interface Requirements Between ECS and External Networks (NSI)
GSFC 423-16-02	PGS Toolkit Requirements Specification for the ECS Project
GSFC 423-16-01	Data Production Software and SCF Standards and Guidelines
GSFC 423-003-C04	Government Furnished Property for the ECS

2.3 Information Documents

The following documents, although not binding for this document, amplify or clarify the information presented in this document.

193-219-SE1-019	IRD Between ECS and EOS AM-1 Flight Project.
	PGS Toolkit User's Guide (latest revision).

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3. Systems Descriptions

The following section provides a summary description of the ECS and SCFs. This section provides functional descriptions of each system, as well as architectural summaries.

Section 3 contains three subsections:

3.1 Systems Relationship Overview

3.2 ECS System Description

3.3 SCF System Description

3.1 Systems Relationship Overview

The ECS and the SCFs work together to support data production software integration and test, product quality assurance, calibration coefficient updates, and product generation. Figures 3-1 and 3-2 and Table 3-1 give overviews of relationships between ECS and the SCFs. The data flow numbers in Table 3-1 correspond to the flow numbers in Figures 4-1, 5-1, 6-1, 7-1, and 8-1.

Figure 3-1 (General Categories of ECS to SCF Interfaces) shows that ECS has resources (colored gray) both in the SCFs and at other locations. This figure is further explained in Section 3.3.3. SCFs have both ECS (gray) and non-ECS (white) resources. Figure 3-2 provides General Functions of ECS-SCF Interfaces that will be elaborated in Sections 4 through 11 consistent with the information flows in Table 3-1, Data Flow Matrix.

Sections 3.2 and 3.3 provide overall views of ECS and a typical SCF in order to form a basis for understanding the interface requirements between the two systems. Note that resource configurations may vary from SCF to SCF and that not all SCFs are required to support all interfaces described in this IRD. The interfaces that a given SCF needs to support will depend on its charter, e.g., data production software development, calibration coefficient analysis and update. The interfaces will be standardized for each SCF function independent of the SCF's resource configuration.

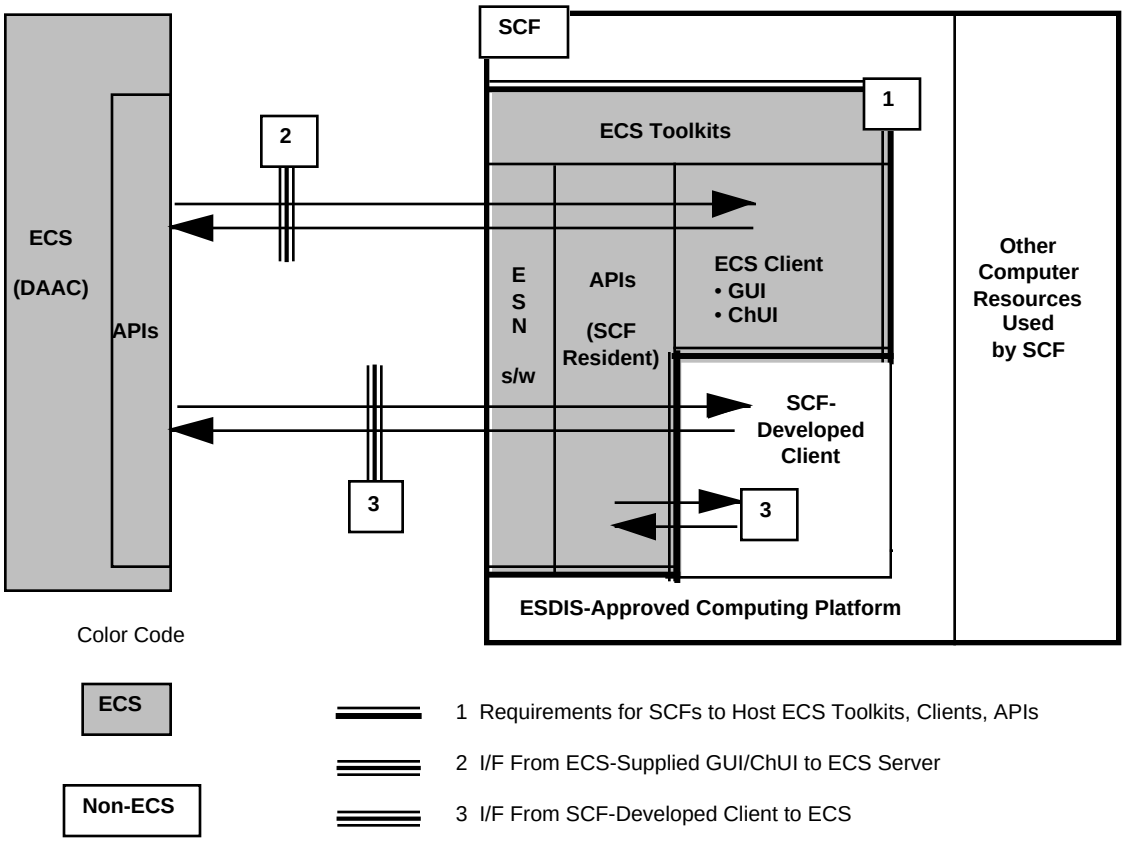

Figure 3-1. Categories of ECS to SCF Interfaces

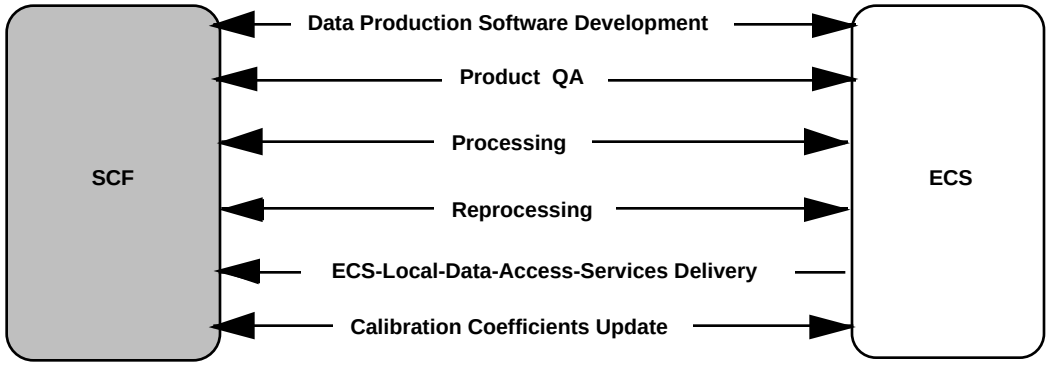

Figure 3-2. General Functions of ECS-SCF Interfaces

Table 3-1. Data Flow Matrix (1 of 3)

Data Flow No.	From	To	Data Flow Name	Data Flow Description
				Section 5. Data Production Software Development
5-5	SCF	ECS	Interactive Session Dialog	Interactive Session Dialog consists of messages that flow between a scientist at an SCF and the ECS that support general communication with the Integration and Test (I&T) service. This includes mail messages, status reports, test coordination, test execution scripts, and schedule product deliveries.
5-5	ECS	SCF	Interactive Session Dialog	Interactive Session Dialog consists of messages that flow between a scientist at an SCF and the ECS that support general communication with the I&T service. This includes mail messages, status reports, test coordination, test execution scripts, and schedule product deliveries.
5-4	ECS	SCF	I&T Requirements	I&T Requirements include documentation, standards, requirements, "Help" service.
5-3	ECS	SCF	Toolkit Delivery and Update Package	PGS Toolkit used to access the production environment and services. These include routines to process file I/O requests, error messages, metadata formatting, geolocation, time conversions, math libraries, etc.
5-6	SCF	ECS	Data Production Software Delivery Package	This consists of the source code for science product generation, job control scripts, data production software documentation, and a reprocessing plan. Data production software are the result of new or updated data production software passing through the I&T.
5-7	ECS	SCF	Test Products	Output from test running data production software includes system messages, error messages, output from data production software, executing time, etc.
5-8	SCF	ECS	Test Product Reviews	Scientist reviews and comments on the quality of the test products and instructions on how to proceed next with the data production software integration and test process.
5-9	SCF	ECS	Data Production Software Updates	Updates are delivered to the ECS by scientists at the SCF. They represent changes to existing data production software, or new data production software to produce new Standard Products. Data production software Updates include the source code, documentation, and a job step control skeleton.

CH01

Table 3-1. Data Flow Matrix (2 of 3)

5-10	SCF	ECS	Special Products	L1 -L4 Special Products	
5-11	SCF	ECS	Metadata	Metadata related to Special Products	
5-12	SCF	ECS	Ancillary Data	Ancillary data related to Special Products that are required as input in the generation of the Special Product. This may include selected engineering data from the EOS spacecraft, as well as non-EOS ancillary data.	
5-13	SCF	ECS	Calibration Data	Calibration data related to Special Products required to perform calibration of the instrument science data and the spacecraft engineering data. It includes pre-flight calibration measurements, in-flight calibrator measurements, etc.	
5-14	SCF	ECS	Correlative Data	Correlative data related to Special Products	
5-15	SCF	ECS	Documents	Documents related to Special Products	
5-16	SCF	ECS	Data Production Software	Data Production Software related to Special Products	
5-17	SCF	ECS	Remote Access Session Dialog	Remote Access Session Dialog consists of commands that flow from the science software developers at the SCF to the science software integration and test tools at the PGS. Functions supported include: compile, link, debug, check code, define and schedule a job, compare files, and science software resource profiling.	CH02
5-17	ECS	SCF	Remote Access Session Dialog	Remote Access Session Dialog consists of responses that flow from the science software integration and test tools at the PGS. Functions supported include: compile, link, debug, check code, define and schedule a job, compare files, and science software resource profiling.	CH02
5-18	SCF	ECS	Browse Data	Browse data pertaining to a Special Product	CH03
5-19	SCF	ECS	Guide Information	Guide information pertaining to a Special Product	CH03
				Section 6. Product QA	
6-1	SCF	ECS	QA Notification Specification	Standing order for or a specified set of conditions for the selection and automatic transmission of product data to the SCF for science QA.	
6-2	ECS	SCF	Data Quality Request Notification	Request to scientist at SCF to perform science QA for a particular product. A time window is applied to the request in keeping with the production schedule.	
6-3	SCF	ECS	Request for Data to QA	Request from the scientist for the data specified in the Data Quality Request Notification and/or other data needed in the QA process.	
6-4	ECS	SCF	Data Delivered for QA	The output products, QA files, metadata, or other requested data to be used for science QA.	
6-5	SCF	ECS	On Time QA	On Time QA describes the results of product QA at the SCF and further instructions to the ECS for updating the metadata.	
6-6	SCF	ECS	Metadata Updates	Updated metadata pertaining to QA process received by ECS after the allocated time window.	
				Section 7. Data Product Processing	
7-1	SCF	ECS	Request for Processing Status	Request from the scientist for information about errors, processing status, schedules, and preliminary outputs.	

7-2	ECS	SCF	Processing Status	This response from ECS provides information that will be contained in PGE status files, data availability schedules, and processing and error logs.
7-3	SCF	ECS	Request for Resource Usage	Request by the scientist for information about the resources used by requested production runs.

Table 3-1. Data Flow Matrix (3 of 3)

7-4	ECS	SCF	Resource Usage	Resource usage includes resource management statistics, configuration management, performance statistics, and accounting information.
7-4	SCF	ECS	Request for Product History	The scientist may request information about the history of a product that may or may not be part of the production run in this section.
7-6	ECS	SCF	Product History	Product history including the production history of specified products and the algorithms used to produce them.
				Section 8. Data Product Reprocessing
8-1	ECS	SCF	Reprocessing Request Template	Template for the reprocessing request.
8-2	SCF	ECS	Reprocessing Request	Reprocessing request including data set identification, start/stop times, data production software identification, ancillary data, etc.
8-3	ECS	SCF	Reprocessing Status	Status on reprocessing request.
				Section 9. ECS Local Data Access Services
9-1	ECS	SCF	Service Delivery Package	Delivery package with software to provide SCF with ECS Local Data Access Services.
				Section 10. Calibration Coefficients Update
10-1	SCF	ECS	Calibration Coefficient Request	Request for the calibration coefficients presently used in processing data from a specific instrument.
10-2	ECS	SCF	Calibration Coefficients	File containing the calibration coefficients presently (or for some other time) being used for a specific instrument.
10-3	SCF	ECS	Calibration Coefficient Update Package	Calibration coefficients update package includes identification of coefficient data set, calibration coefficients values, author and version number, identification and related processing data production software, start and stop date/time of applicability, date, etc.

3.2 EOSDIS Core System (ECS)

3.2.1 ECS Overview

The ECS, the EOS Data and Operations System (EDOS), and the EOS Communications (Ecom) network are components of the EOSDIS. ECS supports the planning, scheduling, and control of U.S. EOS spacecraft and instruments and processing, archival, and distribution of data from EOS instruments. In addition to fully supporting the EOS mission, the ECS provides information management and data archive and distribution functions for all other NASA Earth science flight missions, NASA instruments flown on non-NASA spacecraft, and for all other NASA held Earth science data.

3.2.2 ECS Segment

ECS is composed of three segments defined to support three major operational areas: flight operations, science data processing, and communications/system management. The ECS segments are described below:

a. The Flight Operations Segment (FOS) manages and controls the EOS spacecraft and instruments. The FOS includes the EOS Operations Center (EOC)/Instrument Control Center (ICC), which is responsible for mission planning, scheduling, control, monitoring, and data analysis in support of mission operations for U.S. EOS spacecraft and instruments. The ECS EOC/ICC is located at the Goddard Space Flight Center (GSFC). The FOS also provides investigator-site ECS software (the Instrument Support Toolkit [IST]) to connect a Principal Investigator (PI) or Team Leader (TL) to the FOS in remote support of instrument control and monitoring. (Investigator facilities are outside the FOS, but connected to it by way of the EOSDIS Science Network [ESN] Wide Area Network [WAN].)

b. The Science Data Processing Segment (SDPS) provides a set of ingest, processing, and distribution services for science data and a data information system for the entire EOSDIS. The SDPS processes data from the EOS instruments to Level 1-4 data products. The SDPS also provides short- and long-term storage for EOS, other Earth observing missions, and other related data, software, and results, and distributes the data to EOSDIS users. The SDPS contains a distributed data and information management function and user services suite for the ECS, including a catalog system in support of user data selection and ordering. SDPS elements will be distributed at the following Distributed Active Archive Centers (DAACs):

    1. Goddard Space Flight Center (GSFC), Greenbelt, Maryland
    2. Earth Resources Observation System (EROS) Data Center (EDC), Sioux Falls, South Dakota
    3. Jet Propulsion Laboratory (JPL), Pasadena, California
    4. Langley Research Center (LaRC), Hampton, Virginia
    5. University of Colorado, National Snow and Ice Data Center (NSIDC), Boulder, Colorado
    6. University of Alaska, Alaska Synthetic Aperture Radar (SAR) Facility (ASF), Fairbanks, Alaska*
    7. Marshall Space Flight Center (MSFC), Huntsville, Alabama
    8. Oak Ridge National Laboratory (ORNL), Oak Ridge, Tennessee*

*These DAACs have no ECS-provided product generation capability.

The Consortium for International Earth Science Information Network (CIESIN) Socioeconomic Data and Application Center (SEDAC) will obtain software from ECS to support interoperability, but will have no ECS-provided product generation capability.

c. The Communications and System Management Segment (CSMS) provides overall ECS management of ECS ground system resources, provides facilities and communications/networking services for an extensive science data communications network, and manages the interfaces to the EOS Communications (Ecom) network, the NASA Communications (Nascom) Local Area Network (NOLAN), and the NASA Science Internet (NSI). The CSMS also includes the ESN, which consists of a dedicated internal ECS Wide Area Network (WAN) with circuits provided by the Program Support Communications Network (PSCN); Local Area Networks (LANs) at each of the DAACs and the EOC to support ECS operations; connections to International Partners (IPs); and interfaces at DAACs with Ecom, Nascom, and NSI. The CSMS System Management Center (SMC), along with local system management capabilities at DAAC sites and the EOC, provides system management services for ECS ground system resources. Most of the operations staff is considered part of the SDPS or FOS, including Local System Management (LSM) operators.

3.3 Science Computing Facilities

The SCFs consist of computing facilities that are listed in the GSFC document Government Furnished Property for the ECS. SCFs are used by EOS-funded investigators at their home institutions in order to develop and maintain standard and special product data production software, perform QA, order reprocessing of data, request production status and history files, request resource usage updates, administrate and manage local databases, and update calibration coefficients. Those capabilities are included herein because they are necessary for the SCF to carry out its role as software developer and provider. General user requirements not covered herein consist of those capabilities that all users share, such as conduct of data searches.

The SCFs, owned and operated by the investigators, host ECS-supplied software for a variety of scientific activities and for interfacing with the ECS. This software provides a uniform interface to all SCFs and facilitates easy and direct communication between the investigator and ECS. This access allows investigators to:

a. Have their standard products processed and reprocessed using the ECS production resources;

b. Access data products for the purpose of standard and special product data production software development. These data products may reside at archival facilities internal to ECS, or at facilities external to, but accessible by ECS;

c. Deliver data production software and special product data for archiving;

d. Update calibration coefficients and data production software used in standard product processing; and

e. Conduct quality assurance of data products.

Sections 5 through 10 describe the interfaces for 6 SCF-unique functions that potentially are available to SCFs. Some SCFs may have all 6 functions, some may have one of the 6, and other SCFs may have 2-5 functions chosen from the 6 in response to local priorities. It is not expected that all SCFs will manifest all 6 functions, but all appear herein in order to completely define the interfaces for the maximal set of SCF functions.

3.3.1 SCF Overview

The SCF is part of a data processing facility located at an investigator's institution. ECS supplies the SCF not only the General Application Tools and Graphical User Interface (GUI) Application Tools supplied to the general user, but also additional PGS Toolkit and Science Library.

The PGS Toolkit provides investigators with tools they need to develop data production software and prepare for the operation of their data production software in the production environment. These routines provide file access, job control, error logging, ingest of test data, dynamic storage allocation, standard mathematical operations such as matrix inversion, and fast Fourier transforms. Interface requirements for the PGS Toolkit can be found in the PGS Toolkit Requirements Specification for the ECS Project (GSFC 423-16-02).

A subset of the ECS Data Management, Data Server, and Interoperability services (collectively called ECS Local Data Access Services) are available to the SCFs. These services provide for local management, search, and access to metadata. They are primarily used during data production software testing to ensure that the generated metadata are correctly formatted to ECS standards.

3.3.2 Physical Links to ECS

SCFs may communicate with ECS via both NSI and ESN, or only via NSI, based on their specific requirements. ESN is intended for mission essential use; it will transfer data between sites in support of data production. The ESN connection will be provided by ECS via a government furnished circuit. If required (e.g., in situations in which an SCF is not co-located with a DAAC or where there are particular routing concerns at the SCF location), the SCF will be responsible for providing the router or other device that is the interface between the incoming circuit and the SCF facility. NSI is intended for mission success use; it will provide data to users both within and outside of ECS in response to queries and searches. Many specific networking configurations are possible, but they resolve to two basic cases:

a. The SCF may be a part of (already connected to) an existing Local Area Network (LAN) if colocated with a DAAC. The DAAC LAN will then provide access to both ESN and NSI via router connections.

b. The SCF LAN may be connected to a router (or routers) that provides access to NSI and/or ESN.

Although NSI is the primary Internet provider for ECS, an SCF may access NSI via a different Internet provider. It is expected that new NSI connections will be established for some SCFs.

ECS will support communications using the Transport Control Protocol/Internet Protocol (TCP/IP) protocol suite. In order to size the circuits supporting SCF connections to NSI and ESN, additional information will be necessary regarding performance requirements, data sizes, and number of transfers required from specific SCFs.

3.3.3 Definition of the Interface

Figure 3-1 illustrates three categories of interfaces between ECS and the SCF. Category 1 describes interfaces between the various ECS toolkits resident at the SCF and the ESDIS-approved UNIX computing platform. These interfaces consist of requirements for the SCFs to be capable of hosting ECS toolkits, clients, and the ECS Local Data Access Service. Category 2 consists of interfaces that physically exist between the SCF and ECS servers. For example, these flows include data production software updates from the SCF to the ECS. These flows are initiated by the scientist though interaction with the Graphical User Interface (GUI) and Character User Interface (ChUI). Category 3 closely resembles Category 2 except that SCF developed clients initiate flows by operating through ECS-provided APIs

The general SCF requirements in Section 4 include standards and guidelines to which SCFs must adhere and computing resources that SCFs must supply.

A more tangible view of the category 2 and 3 ECS-SCF interfaces is the data flowing between the ECS and ECS-software resident at the SCF. These flows occur through the ECS-supplied ESN software package. For example, the SCF could transmit some or all of the following to the ECS: L1 to L4 Special Products, metadata, ancillary data, test data, calibration data, correlative data, QA results, documents, and data production software. In turn, the ECS could transmit some or all of the following to the SCF: L0 to L4 Standard and Special Products, data production software test results, metadata, ancillary data, calibration data, correlative data, QA requests, documents, and data production software. Detailed descriptions of these data flows appear in Sections 5 through 10.

As previously described, Sections 5 through 10 organize the ECS to SCF interfaces into 6 functional areas. Each section presents data flow descriptions and the interface requirements for accomplishment of its function.

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4. General SCF Requirements

4.1 Description of Requirements

This section contains general requirements that apply to all SCF interfaces in sections 5 through 10.

4.2 Requirements

SCF-0001 The SCF interface platform shall adhere to requirements specified in the Data Production Software and SCF Standards and Guidelines, GSFC 423-16-01. This standards document includes SCF requirements for operating system, computer communications, e-mail protocol, and windowing protocol.

SCF-0010 The SCF interface shall consist of an ESDIS approved computing platform that shall have a C compiler. To access FORTRAN routines in the ECS Toolkits, the platform shall also have a FORTRAN compiler.

SCF-0020 The SCF interface platform shall have an I/O communication port and the ability to run TCP/IP software for communication to the ECS.

SCF-0025 The SCF interface platform shall provide one of the following levels of security for interoperation with ECS:

a. Kerberized authentication for bi-directional file transfers.

b. Use of Distributed Computing Environment (DCE) for authentication of users, authorization of users for access to services such as remote file access, and provision for integrity of data being transferred.

SCF-0030 The SCF interface platform shall have adequate computing resources for the storage, compilation, linking, and execution of ECS supplied software resident on the platform.

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5. Data Production Software Development

5.1 Data Flow Descriptions

Figure 5-1 shows the associated data flows required for Data Production Software Development. The numbering scheme for data flows consists of a section number and a flow number separated by a hyphen.

CH01

The ECS Toolkit Delivery and Update Package (5-3), made available to the SCFs, includes the PGS Toolkit, the Science Libraries, and the ESN software. The transfer is accomplished electronically or by various storage media. Updates to this software are also distributed electronically or on media. SCFs are unique in that they receive special Toolkit capabilities not available to the general user. Specifically, the SCFs receive the PGS Toolkit for data production software development and production environment emulation. The PGS Toolkit plays an integral role in the development of data production software at the SCFs. The Toolkit supplies tools for the emulation of the PGS environment at the SCF -- tools that serve to insulate the scientist from the details of the ECS system architecture, implementation, and evolution. The PGS Toolkit also contains mandatory functions that deal with input/output (I/O), error message transactions, process control, ancillary data access, spacecraft ephemeris and attitude, and time and date transformations. The PGS Toolkit also has optional functions such as those involving celestial body positions, coordinate transformations, mathematics libraries, physical constants, and graphic support. Storage requirements are addressed in the PGS Toolkit User's Guide. The Science Libraries support data production software development, use of APIs, and ingest preparation.

All general users have available the ESN software and the General Application Tools and GUI Application Toolkits. The ESN software provides communication capabilities between ECS and users. The General Application Tools support the searching, locating, and obtaining of data from research campaigns or other instruments. The General Application Tools also provide additional data handling capabilities, such as data subsetting, reformatting, compression, and transformation.

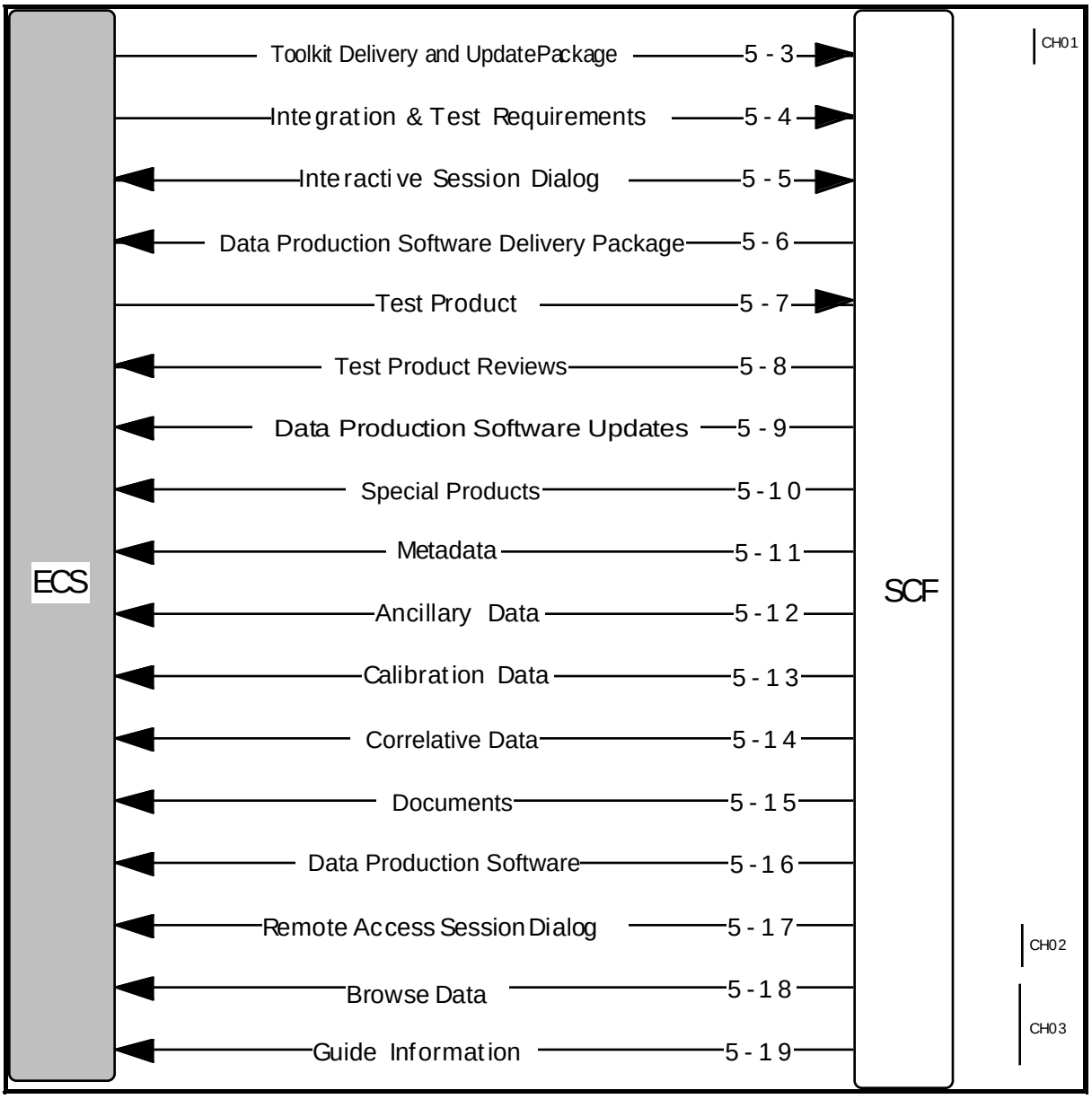

Figure 5-1. Data Flows for Data Production Software Development

I&T Requirements (5-4) are provided to the scientist as a support for smooth data production software integration. These must be followed by both the SCF and ECS for the data production software to be successfully integrated into the production environment.

A more informal dialogue also takes place between the Algorithm Support Team and the SCF investigator team during the I&T process called Interactive Session Dialog (5-5). This includes messages regarding technical and science issues, status reports, test coordination, test execution

scripts, and solutions to minor problems. Its purpose is to facilitate the integration and test process of data production software by the involvement of all necessary parties.

The SCF delivers a Data Production Software Delivery Package (5-6) to the ECS Algorithm Support Team. ECS and SCF I&T personnel conduct the actual integration and testing at a DAAC under the control of the DAAC Manager. The delivery package contains, at a minimum, the following: data production software (source code, script files, and makefiles), configuration information (version numbers, format listings, extent of PGS Toolkit usage, and SCF contact person), test specifications, test data files (all necessary science, engineering, and ancillary files, calibration coefficients), operations concept and design specifications, expected test results, and reprocessing plan.

As part of the ongoing integration and test process, the SCF receives Test Products (5-7), generated by the science software at the ECS, for review and possible modification. The scientist reviews the test products and forwards the review (5-8) to the ECS Integration and Test office including the scientist's comments and recommendations. As a result of these test product reviews, the scientist may choose to make modifications to the data production software. Any such changes in the data production software are forwarded to the ECS as Data Production Software Updates (5-9) for further integration and testing.

Additionally, any Special Products generated at an SCF can be sent to the ECS for archiving. These include L1 - L4 Special Products (5-10) and their related Metadata (5-11), Ancillary Data (5-12), Calibration Data (5-13), Correlative Data (5-14), Documents (5-15), and Data Production Software (5-16). The SCF may also send Browse data (5-18) and Guide information (5-19) for a
Special Product to ECS. The guide information consists of documentation and reference material. This provides a means of making these data available to the science community at large. CH03
Remote access from the SCF to the science software integration and test services is supported for predelivery checkout of the science software at the DAAC by the science software development teams. CH02 The science software development team may remotely compile, link, debug, check code, define and schedule a job, compare files, and perform science software resource profiling (5-17).

5.2 Functional Requirements

The following requirements pertain to SCFs that plan to perform data production software development and do not pertain to all SCFs:

CH01

SCF-0060 The ECS shall have the capability to provide to the SCF the Toolkit Delivery and Update Package. This package includes the PGS toolkit which supplies tools for the emulation of the ECS production environment

and contains a ECS-standardized software routines to aid in science data production software development.

SCF-0070 The ECS shall have the capability to provide Integration and Test Specifications to the scientist at the SCF. These specifications are defined by the Data Processing Focus Team. These specifications are implemented in the Data Production Software Delivery Package and support smooth integration of the data production software into the ECS production environment.

SCF-0080 The ECS shall have the capability to provide an Interactive Session Dialog with the SCF. This dialog, to aid integration and test of the data production software into the ECS production environment, shall support, at a minimum, general communications between the ECS and the SCF that include logins, mail messages, status reports, test coordination, test execution scripts, and solutions to minor problems.

SCF-0085 The ECS shall support remote science software integration and test activities at the DAACs including:

a. executing code checkers, compiling, linking, debugging code, file comparison and science software resource profiling from the SCF; CH02

b. interactive remote access from the SCF to a job scheduling tool for defining and executing jobs.

SCF-0090 The SCF shall have the capability to provide ECS with the Data Production Software Delivery Package with "Required Items For Delivery" as specified by the Science User's Guide and Operations Procedure Handbook for the ECS Project.

SCF-0100 The ECS shall have the capability to forward Test Products to the SCF. These products generated by the science software at the ECS will require the review of the scientist at the SCF who submitted the software.

SCF-0110 The ECS shall have the capability to receive Test Product Reviews from the SCF. These reviews shall include the comments and recommendations of the scientist at the SCF who has reviewed the Test Products.

SCF-0120 The ECS shall have the capability to receive Data Production Software Updates from the SCF. These Data Production Software Updates include modifications to any data production software already submitted to the ECS by the SCF. The Data Production Software Updates may include some or all the items required in the Data Production Software Delivery Package.

SCF-0130 The ECS shall have the capability to receive Special Products from the SCF. These shall include L1 - L4 Special Products.

SCF-0140 The ECS shall have the capability to receive Metadata, related to Special Products, from the SCF.

SCF-0150 The ECS shall have the capability to receive Ancillary Data, related to Special Products, from the SCF.

SCF-0160	The ECS shall have the capability to receive Calibration Data, related to Special Products, from the SCF.	
SCF-0170	The ECS shall have the capability to receive Correlative Data, related to Special Products, from the SCF.	
SCF-0180	The ECS shall have the capability to receive Documents from the SCF that are related to Special Products and deemed necessary by the contributing scientist.	
SCF-0190	The ECS shall have the capability to receive Data Production Software, related to Special Products, from the SCF.	
SCF-0192	The ECS shall have the capability to receive Browse Data, related to Special Products, from the SCF.	CH03
SCF-0194	The ECS shall have the capability to receive Guide Information related to Special Products, from the SCF.	CH03

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6. Product QA

6.1 Data Flow Descriptions

Figure 6-1 shows the associated data flows required for Product QA.

Investigator teams at the SCFs may provide operational support to ECS data processing by performing quality analysis of standard products and their associated metadata. Data fields related to the quality of the standard products are stored in the product metadata during routine processing. The values of these QA fields may be set automatically through the use of QA data production software or as a result of manual inspection by the Quality Assurance Monitor at the DAAC. The QA data production software are quality assurance software supplied by the scientists at some of the SCFs and are part of the Data Production Software Delivery Package sent to the ECS Data Production Software Integration and Test Office. These QA data production software generally perform simple checks of the data's scientific validity.

The scientist at the SCF determines the conditions under which data should be forwarded to the SCF for QA by submitting a QA Notification Specification (6-1) to the ECS. The specification provides the ECS with the information they need so that specific conditions (perhaps certain QA failure codes or combinations of codes, or specific data start and stop times) could trigger a Data Quality Request Notification (6-2) to be sent to the SCF for a given standard product file. The QA Notification Specification could also allow the scientist to spot check production based on a time interval or some number of products.

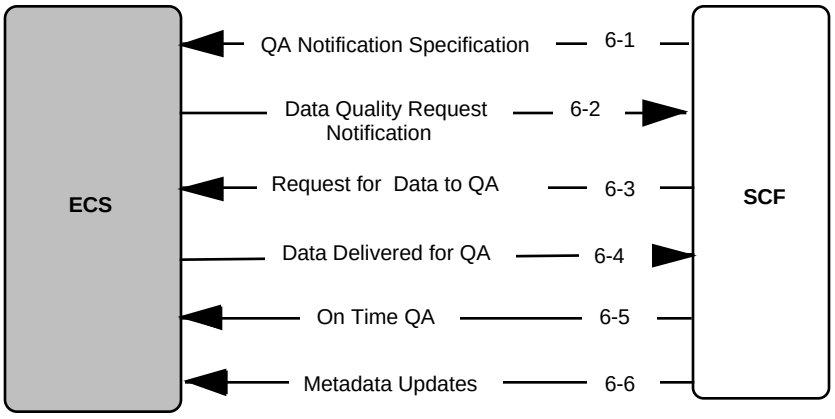

Figure 6-1. Data Flows for QA of Data Products

When these QA selection criteria are met during routine ECS processing, the SCF receives a Data Quality Request Notification identifying the data product and the time by which the data must be evaluated and returned to the ECS for inclusion as an update to the product metadata. The notification could include the product itself and other information that is consistent with the QA Notification Specification that the scientist initially provided. The scientist then sends a Request for Data to QA (6-3) which includes the data product described in the Data Quality Request Notification and any other data that might be needed to assess the quality of the product in question. This data is sent to the SCF as Data Delivered for QA (6-4). The On Time QA (6-5) consists of the science QA codes and optional reports describing the results of product QA and any further instructions to the ECS. The QA code(s) will be included in the product metadata after they are received at the ECS. If the On Time QA is not received within the time limit, a flag is set within the product metadata to reflect that no QA validation has been performed on the data and the product is archived. When the On Time QA is subsequently received at the ECS (Metadata Updates [6-6]), the metadata corresponding to the archived data is updated. Products will be made available for distribution whether or not their On Time QA flag is set. Processing of products that need QA will be delayed until that QA is completed or until after completion of a time-out period if specified by the scientist.

A typical scenario is the following: during normal production an automatic production check specified by the scientist detects a potential problem (e.g., parameter out of range). Per the scientist-specified production script, a message is sent to the scientist and production is halted pending direction from the scientist at the SCF. Additionally, supporting information -- such as ancillary production inputs, status log information, and calibration coefficient files -- may be automatically delivered to the SCF, per the scientist's script, to aid local SCF analysis of the problem. After analysis, the scientist determines that there is a fundamental problem, with the algorithm or inputs and decides that the product should not be archived. The scientist would be kept well aware of the details of the aforementioned situation if it occurred.

6.2 Functional Requirements

The following requirements pertain to SCFs that plan to perform product QA and do not pertain to all SCFs:

SCF-0200 The ECS shall have the capability to receive from the SCF a QA Notification Specification. This specification, submitted by the scientist at the SCF, describes the conditions under which data should be forwarded to the SCF for QA.

SCF-0210 The ECS shall have the capability to send a Data Quality Request Notification to the SCF. This notification is sent when QA notification criteria are met during routine ECS processing. The notification states the data product and the time by which a notification, and optionally data, must be evaluated and returned to the ECS for inclusion as an update to the product metadata.

SCF-0220 The ECS shall have the capability to receive from the SCF a Request for Data to QA. This request may be a standing request specified in the QA Notification Specification and may include the data product specified in the Data Quality Request Notification, or other data required by the scientist to QA the data product.

SCF-0230 The ECS shall have the capability to send Data Delivered for QA to the SCF. This data includes the data requested by the scientist needed for the QA of data products.

SCF-0240 The ECS shall have the capability to receive an On Time QA from the SCF. This shall consist of the science QA codes describing the results of product QA and any further instructions to the ECS. The ECS shall accept the On Time QA when it is received within the time-out period specified in the Data Quality Request Notification. ECS shall accept post-time-out QA updates as Metadata Updates as specified by Requirement SCF-0250.

SCF-0250 The ECS shall have the capability to receive Metadata Updates from the SCF. These shall include the science QA codes and optionally a report describing the results of product QA and any further instructions to the ECS. The ECS shall only accept Metadata Updates when they are received after the time allotment specified in the Data Quality Request Notification.

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7. Data Product Processing

7.1 Data Flow Descriptions

Figure 7-1 shows the associated data flows required to support DAAC Data Processing.

The ECS may process data products for the SCF on a regular basis or by request. Because the SCF is ultimately responsible for the data products, there must exist a means by which the SCF can obtain the status of production runs. A Request for Processing Status (7-1) is an SCF request for information about schedules, processing status, preliminary outputs, and errors. The ECS Processing Status (7-2) response provides status information that is contained in Product Generation Executable (PGE) status files, data availability schedules, and processing and error logs. Processing Status will be accessible to the SCF upon request near the time of processing.

An SCF also can issue a Request for Resource Usage (7-3) for production runs requested by the SCF. The Resource Usage information that ECS provides (7-4) includes details about resource usage, resource management statistics, configuration management, performance statistics, and accounting information.

An SCF may issue a Request for Product History (7-5) that is not necessarily related to the above mentioned production runs. ECS will provide Product History information (7-6) including the production history of specified data products, the algorithms used to produce them, the science team that wrote the algorithms, information on the input databases, and indication of any atypical execution options that were selected for the running of the algorithm.

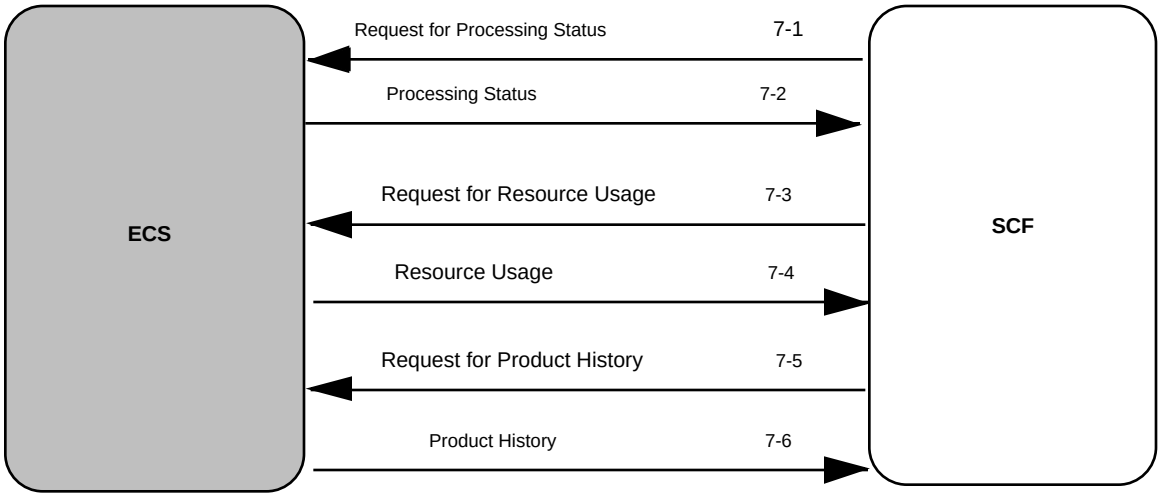

Figure 7-1. Data Flows for Data Processing

7.2 Functional Requirements

The following requirements pertain to SCFs that plan to support ECS data product processing and do not pertain to all SCFs:

SCF-0340 The SCF shall have the capability to send a Request for Processing Status to the ECS for the status of SCF-requested data processing.

SCF-0350 The ECS shall have the capability to provide SCF with the Processing Status of SCF-requested data processing.

SCF-0360 The SCF shall have the capability to send a Request for Resource Usage to the ECS for information about ECS resource usage during SCF-requested data processing.

SCF-0370 The ECS shall have the capability to provide SCF with information about ECS Resource Usage during SCF-requested data processing.

SCF-0380 The SCF shall have the capability to send a Request for Product History (including the algorithms used) to the ECS for the history of data products that the SCF specifies.

SCF-0390 The ECS shall have the capability to provide SCF with the Product History of data products that the SCF specifies.

8. Data Product Reprocessing

8.1 Data Flow Descriptions

Figure 8-1 shows the associated data flows required for Data Product Reprocessing.

Reprocessing Requests (8-2) may be sent from the SCF to the ECS for a number of reasons. Reprocessing might be necessitated by a data production software modification, changes in calibration coefficients, or availability of more accurate sources of ancillary data. Requests for reprocessing may range from a single standard product to several months worth of data for multiple products or instruments. A Reprocessing Request Template to use in preparing these requests is provided by the ECS (8-1). This template is essentially a form containing types of information that the SCF should provide.

A Reprocessing Request, at a minimum, contains the following information: reason for request, proposed reprocessing schedule, the time and data set range of the request, a list of all the products to be generated, the version numbers of the science software and calibration coefficients, and a list of necessary ancillary data. Upon NASA approval, the data product reprocessing can be scheduled. Reprocessing Status (8-3) keeps the scientist updated on the status of his request and provides notification upon completion of the reprocessing.

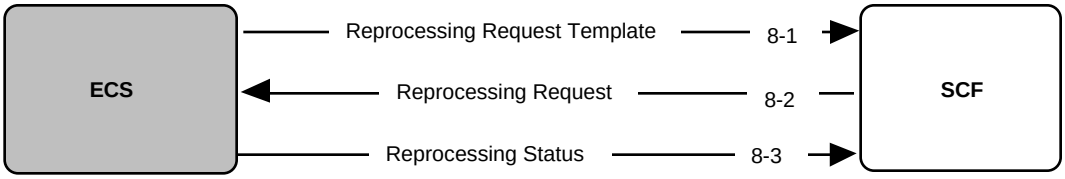

Figure 8-1. Data Flows for Reprocessing of Data Products

8.2 Functional Requirements

The following requirements pertain to SCFs that plan to request and support data product reprocessing and do not pertain to all SCFs:

SCF-0260 The ECS shall have the capability to make a Reprocessing Request Template available to the SCF. This template will be used by the scientist at the SCF to prepare a Reprocessing Request.

SCF-0270 The ECS shall have the capability to receive a Reprocessing Request from the SCF. This request, at a minimum, contains the following, a list of all the products to be generated, the version numbers of the science software and calibration coefficients, a list of all ancillary data, and data start and stop times.

SCF-0280 The ECS shall have the capability to supply a Reprocessing Status to the SCF. This status that includes the reprocessing schedule informs the scientist at the SCF the status of his reprocessing request and provides notification upon completion of the reprocessing by the ECS.

9. ECS Local Data Access Services

9.1 Data Flow Descriptions

Figure 9-1 shows the associated data flows required for delivery of the ECS services that support local data access by SCFs.

A subset of the ECS Data Management, Data Server, and Interoperability services (collectively called ECS Local Data Access Services or LDAS) is available to the SCFs. The LDAS provide for local management, search, and access to metadata. LDAS are used during data production software testing and facilitate the importation of the metadata into the ECS. LDAS require ECS supported COTS products which are to be provided by the SCF and for which an application interface has been developed in the core system.

In the future, the LDAS may be expanded to permit the SCF to make data available to other ECS users through the ECS Advertising Service. The interfaces required to support this capability will be described in the ECS Service Provider Interface Description Document CH02.

9.2 Functional Requirements

The following requirements pertain to SCFs that plan to provide local data access services and do not pertain to all SCFs:

SCF-0290 The ECS shall have the capability to send the Local Data Access Services Delivery Package to the SCF. This package shall provide management of, search of, and access to local metadata.

SCF-0300 The SCF shall have the capability to install and make operational in the SCF environment all COTS products that are required by Local Data Access Services.

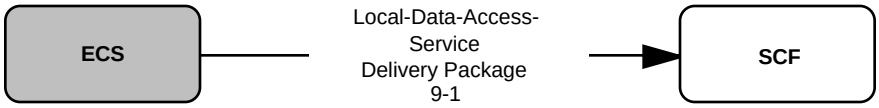

Figure 9-1. Data Flows for Local Data Access Services

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10. Calibration Coefficients Update

10.1 Data Flow Descriptions

Figure 10-1 shows the associated data flows required for Calibration Coefficients Update.

Data production software calibration coefficients may be modified for a number of reasons. Changes in calibration coefficients may be suggested as a result of ongoing science software development, to reduce discrepancy with ground truth data, or may be required due to variations in the instrument sensor itself.

The current or past calibration coefficients used in the processing of instrument data are requested through a Calibration Coefficient Request (10-1) from the SCF to ECS. The requested calibration coefficients are sent to the SCF as Calibration Coefficients (10-2). Requests for updates to calibration coefficients are made via the Calibration Coefficient Update Package (10-3), which includes a calibration coefficient file and other documentation needed to implement the updated coefficients. Calibration coefficient verification by ECS includes checking the number of coefficients, range of values, and data format.

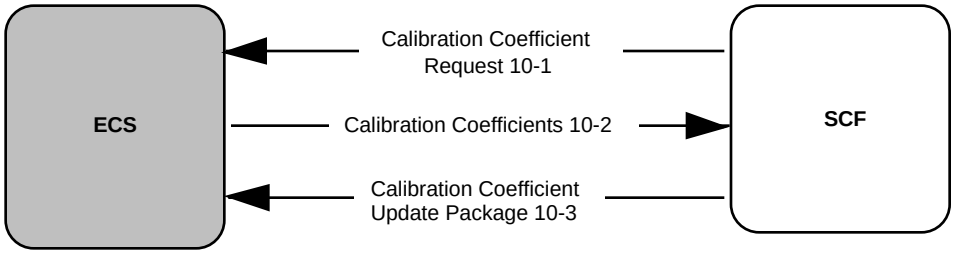

Figure 10-1. Data Flows for Calibration Coefficient Update

10.2 Functional Requirements

The following requirements pertain to SCFs that plan calibration coefficients update and do not pertain to all SCFs:

SCF-0310 The ECS shall have the capability to receive Calibration Coefficient Requests from the SCF. The current or past calibration coefficients used in processing of instrument data may be requested by the scientist from the ECS.

SCF-0320 The ECS shall be capable of sending to the SCF Calibration Coefficients. These shall include the calibration coefficients requested by the scientist at the SCF in the Calibration Coefficient Request.

SCF-0330 The ECS shall have the capability to receive a Calibration Coefficient Update Package from the SCF. This package shall include a calibration coefficient file and other documentation needed to implement the updated coefficients.

11. Interface Control Documentation Plan and Requirements Trace

11.1 Interface Control Documentation Plan

A single ECS-SCF ICD will be written to define the design of the interfaces specified in this IRD. The ECS-SCF ICD was baselined for ECS Release A in January 1996. ECS Release B changes are scheduled to be baselined in the ECS-SCF ICD in August 1996. CH03

11.2 Requirements Trace

All requirements except for SCF-0001 and SCF-0020 in this IRD trace to higher level requirements in the Functional and Performance Requirements Specification for the Earth Observing System Data and Information System (EOSDIS) Core System (F&PRS) as shown in Table 11-1, ECS-SCF IRD Requirements Trace. The requirement numbers in the first column of this table contain the numeric identifications of the requirements in Sections 4 through 10. The parent requirements in the second column consist of requirements in the (F&PRS) from which the ECS-SCF requirements in the same row of the matrix can be derived. For example, SCF-0060 traces to parent requirement number PGS 1030. CH01

Table 11-1. ECS-SCF Interface Requirements Trace (1 of 2)

Requirement Number	Parent Requirements (D/ = Derived From ...)	
SCF-0001	NASA Direction	
SCF-0010	PGSTK-0101, PGS-0602	
SCF-0020	ESN-1340	
SCF-0025	ESN-1400	
SCF-0030	D/DADS0190	
		CH01
SCF-0060	PGS-1030	
SCF-0070	PGS-0640	
SCF-0080	PGS-0860, EOSD1750, EOSD-1760	
SCF-085	PGS-0915	CH02
SCF-0090	PGS-0640	
SCF-0100	PGS-0900, PGS-0605	
SCF-0110	PGS-0640	
SCF-0120	PGS-0640	
SCF-0130	DADS-0190	
SCF-0140	DADS-0190	

Table 11-1. ECS-SCF Interface Requirements Trace (2 of 2)

SCF-0150	DADS-0190	
SCF-0160	DADS-0190	
SCF-0170	DADS-0190	
SCF-0180	DADS-0190	
SCF-0190	DADS-0190	
SCF-0192	D/DADS-0190, D/DADS-0450	CH03
SCF-0194	IMS-0410	CH03
SCF-0200	D/PGS-1130	
SCF-0210	D/PGS-1130, D/PGS-0860	
SCF-0220	D/PGS-1130	
SCF-0230	D/PGS-1130	
SCF-0240	PGS-1130, SPDS-0091, SDPS-050	
SCF-0250	D/PGS-1130, DADS-0010	
SCF-0260	D/EOSD-1720	
SCF-0270	EOSD-1720	
SCF-0280	IMS-1050	
SCF-0290	EOSD-0502, IMS-1440	
SCF-0300	IMS-1400	
SCF-0310	D/DADS-2380	
SCF-0320	DADS-2380	
SCF-0330	EOSD-1750, PGS-0610	
SCF-0340	D/IMS-1330	
SCF-0350	IMS-1330	
SCF-0360	D/IMS-1660, D/PGS-0650	
SCF-0370	IMS-1660, PGS-650	
SCF-0380	D/IMS-0545	
SCF-0390	IMS-0545	

Abbreviations and Acronyms

API	application programming interface
CCB	Configuration Control Board
ChUI	character user interface
CSMS	Communications and Systems Management Segment (ECS)
DBMS	data base management system
DCE	distributed computing environment
DCN	document change notice
Ecom	EOS Communications
EOS	Earth Observing System
ESA	European Space Agency
ESDIS	Earth Science Data and Information System
ESN	EOSDIS Science Network (ECS)
FOS	Flight Operations Segment (ECS)
F&PRS	Functional and Performance Requirements Specification
GUI	graphic user interface
I&T	Integration and Test
I/O	input/output
ICC	Instrument Control Center (ECS)
ICD	interface control document
IST	Instrument Support Toolkit
LAN	local area network
LDAS	Local Data Access Services
NASA	National Aeronautics and Space Administration
NOAA	National Oceanic and Atmospheric Administration
NSI	NASA Science Internet
PI	principal investigator

PSCN	Program Support Communications Network
PGE	Product Generation Executable
QA	quality assurance
SDPS	Science Data Processing Segment
SMC	System Management Center (ECS)
TCP/IP	Transmission Control Protocol/Internet Protocol
TL	team leader